

400Gb/s QSFP-DD DR4 Transceiver

Current Document Version V1.0



Key Feature

- Compliant with IEEE 802.3cn and IEEE 802.3bs
- Compliant with QSFP-DD MSA
- Management interface based on CMIS 5.0 or updated version
- Optical Interface: 106.25 Gbps (PAM4) x 4
- Electrical Interface: 53.125 Gbps (PAM4) x 8
- Parallel 4 Optical Lanes
- Up to 500m over SMF with FEC
- Case operating temperature: 0°C to 70°C
- Single 3.3V power supply
- Power consumption: 9.5W Max.
- MPO-12/APC connector
- RoHS compliant

Applications

- 400G Ethernet
- Data center

Ordering Information - 400G QSFP-DD DR4

Part No.	Data Rate	Distance	Wavelength	Media	Connector	Temp.
LTG0-UDR04MC	400G	500m	1310nm	SMF	MPO-12/APC	C

Product Description

The LTG0-UDR04MC is an Eight-Channel electrical, Four-Channel optical, pluggable, single mode fiber, QSFP-DD transceiver for 400 Gigabit Ethernet applications. It converts eight host electrical data lanes in each direction at 53.125Gbps into four optical lanes at 106.25Gbps. An optical fiber cable with an MPO-12 connector can be plugged into the module receptacle. Proper alignment is ensured by the guide pins inside the receptacle. The cable usually cannot be twisted for proper channel to channel alignment.

It allows communication up to 500m over single-mode optical fiber cable. These modules are designed to operate over single-mode fiber systems using 1310nm wavelength. This high-performance transceiver module is intended for medium-range SMF data communication and interconnect applications.



Absolute Maximum Rating

Parameter	Symbol	Min.	Max.	Unit	Note
Supply Voltage	VCC	-0.5	3.6	V	
Storage Temperature	TS	-40	85	°C	
Relative Humidity	RH	5	85	%	
Damage Threshold, each lane		6.6		dBm	

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ	Max.	Unit	Note
Electrical Signal Rate, each lane		26.5625 ± 100ppm			GBd	
Optical Signal Rate, each lane		53.125 ± 100ppm			GBd	
Supply Voltage	Vcc	3.135	3.3	3.465	V	
Operating Case Temp.	Tc	0	-	70	°C	
Power Consumption	Pc			9.5	W	
Link Distance with G.652	DI	2		500	m	


Optical Characteristics (Under Recommended Operating Conditions)

Parameter	Symbol	Min	Typ	Max	Unit	Note
Transmitter						
Signaling Speed per Lane		53.125 ± 100 ppm			GBd	
Modulation format		PAM4				
Lane wavelengths (range)	λ	1304.5	1310	1317.5	nm	
Average launch power, each lane	P	-2.9		4	dBm	1
OMAouter, each lane	POMA	-0.8		4.2	dBm	2
Launch power in OMAouter minus TDECQ, each lane		-2.2			dBm	
Transmitter and dispersion eye closure for PAM4 (TDECQ), each lane				3.4	dB	
Side-mode suppression ratio (SMSR)		30			dB	
Extinction ratio	ER	3.5			dB	
Average launch power of OFF transmitter, each lane	Poff			-15	dBm	
RIN21.4OMA	RIN			-136	dB/Hz	
Optical return loss tolerance				21.4	dB	
Transmitter reflectance				-26		3
Receiver						
Signaling Speed per Lane		53.125 ± 100 ppm			GBd	
Modulation format		PAM4				
Lane wavelengths (range)	λ	1304.5	1310	1317.5	nm	
Damage Threshold, each lane		5			dBm	4
Average receive power, each lane		-5.9		4	dBm	5
Receive power (OMAouter), each lane	R_{OMA}			4.2	dBm	
Receiver Reflectance				-26	dB	
Receiver sensitivity (OMAouter), each lane	SEN	max(-3.9, SECQ-5.3)			dBm	6
LOS Assert		-26			dBm	
LOS De-Assert				-8	dBm	
LOS Hysteresis		0.5			dB	

Notes:

1. Average launch power, each lane (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.
2. Even if the TDECQ < 1.4 dB for an extinction ratio of ≥ 4.5 dB or TDECQ < 1.3 dB for an extinction ratio of <4.5 dB, the POMA(min) must exceed this value.
3. Transmitter reflectance is defined looking into the transmitter.
4. The receiver shall be able to tolerate, without damage, continuous exposure to an optical signal having this average power level. The receiver does not have to operate correctly at this input power.
5. Average receive power, each lane(min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.
6. Receiver sensitivity (OMAouter), each lane (max) is informative and is defined for a transmitter with a value of SECQ up to 3.4dB. Bit error ratio (BER) less than 2.4×10^{-4}



Electrical Characteristics (Under Recommended Operating Conditions)

Parameter	TestPoint	Min	Typ	Max	Unit	Note
High Speed Electrical Input Characteristics						
Signaling rate per lane	TP1	26.5625±100ppm			GBd	
Differential pk-pk input voltage tolerance	TP1a	900			mV	1
Single-ended voltage tolerance	TP1a	-0.4		3.3	V	
DC common mode voltage	TP1	-350		2850	mV	2
High Speed Electrical Output Characteristics						
Signaling rate per lane	TP4	26.5625±100ppm			GBd	
AC common-mode output voltage (RMS)	TP4			17.5	mV	
Differential peak-to-peak output voltage	TP4			900	mV	
Near-end ESMW (Eye symmetry mask width)	TP4	0.265			UI	
Near-end Eye height, differential	TP4	70			mV	
Far-end ESMW (Eye symmetry mask width)	TP4	0.2			UI	
Far-end Eye height, differential	TP4	30			mV	
DC common mode voltage	TP4	-350		2850	mV	2

Notes:

1. With the exception to IEEE802.3bs 120E.3.1.2 that the pattern is PRBS31Q or scrambled idle.
2. DC common mode voltage generated by the host. Specification includes effects of ground offset voltage.

Digital Diagnostic Monitor Accuracy

The following characteristics are defined over recommended operating conditions.

Parameter	Accuracy	Unit	Note
Measured transceiver temperature	±3	°C	
Measured transceiver supply voltage	±3	%	
Measured Tx bias current	±10	%	
Measured Tx output power	±3	dB	
Measured Rx received average optical power	±3	dB	



QSFP-DD PIN Function Definitions

Pin	Logic	Symbol	Description	Plug Sequence	Notes
1		GND	Ground	1B	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	3B	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	3B	
4		GND	Ground	1B	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	3B	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	3B	
7		GND	Ground	1B	1
8	LVTTL-I	ModSelL	Module Select	3B	
9	LVTTL-I	ResetL	Module Reset	3B	
10		VccRx	+3.3V Power Supply Receiver	2B	2
11	LVCOMS-I/O	SCL	TWI Serial Interface Clock	3B	
12	LVCOMS-I/O	SDA	TWI Serial Interface Data	3B	
13		GND	Ground	1B	1
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	3B	
15	CML-O	Rx3n	Receiver Inverted Data Output	3B	
16		GND	Ground	1B	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	3B	
18	CML-O	Rx1n	Receiver Inverted Data Output	3B	
19		GND	Ground	1B	1
20		GND	Ground	1B	1
21	CML-O	Rx2n	Receiver Inverted Data Output	3B	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	3B	
23		GND	Ground	1B	1



24	CML-O	Rx4n	Receiver Inverted Data Output	3B	
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	3B	
26		GND	Ground	1B	1
27	LVTTL-O	ModPrsL	Module Present	3B	
28	LVTTL-O	IntL/RxLOSL	Interrupt/optional RxLOS	3B	
29		VccTx	+3.3V Power Supply Transmitter	2B	2
30		Vcc1	+3.3V Power Supply	2B	2
31	LVTTL-I	LPMode/TxDis	Low Power Mode/optional TX Disable	3B	
32		GND	Ground	1B	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	3B	
34	CML-I	Tx3n	Transmitter Inverted Data Input	3B	
35		GND	Ground	1	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	3B	
37	CML-I	Tx1n	Transmitter Inverted Data Input	3B	
38		GND	Ground	1B	1
39		GND	Ground	1A	1
40	CML-I	Tx6n	Transmitter Inverted Data Input	3A	
41	CML-I	Tx6p	Transmitter Non-Inverted Data Input	3A	
42		GND	Ground	1A	1
43	CML-I	Tx8n	Transmitter Inverted Data Input	3A	
44	CML-I	Tx8p	Transmitter Non-Inverted Data Input	3A	
45		GND	Ground	1A	1
46	LVCOMS/CML-I	P/VS4	Programmable/Module Vendor Specific 4	3A	3
47	LVCOMS/CML-I	P/VS1	Programmable/Module Vendor Specific 1	3A	3
48		VccRx1	3.3V Power Supply	2A	2
49	LVCOMS/CML-I	P/VS2	Programmable/Module Vendor Specific 2	3A	3
50	LVCOMS/CML-I	P/VS3	Programmable/Module Vendor Specific 3	3A	3
51		GND	Ground	1A	1
52	CML-O	Rx7p	Receiver Non-Inverted Data Output	3A	



53	CML-O	Rx7n	Receiver Inverted Data Output	3A	
54		GND	Ground	1A	1
55	CML-O	Rx5p	Receiver Non-Inverted Data Output	3A	
56	CML-O	Rx5n	Receiver Inverted Data Output	3A	
57		GND	Ground	1A	1
58		GND	Ground	1A	1
59	CML-O	Rx6n	Receiver Inverted Data Output	3A	
60	CML-O	Rx6p	Receiver Non-Inverted Data Output	3A	
61		GND	Ground	1A	1
62	CML-O	Rx8n	Receiver Inverted Data Output	3A	
63	CML-O	Rx8p	Receiver Non-Inverted Data Output	3A	
64		GND	Ground	1B	1
65		NC	No Connect	3A	3
66		Reserved	For future use	3A	3
67		VccTx1	3.3V Power Supply	2A	2
68		Vcc2	3.3V Power Supply	2A	2
69	LVCOMS-I	ePPS/Clock	1PPS PTP clock or reference clock input	3A	3
70		GND	Ground	1A	1
71	CML-I	Tx7p	Transmitter Non-Inverted Data Input	3A	
72	CML-I	Tx7n	Transmitter Inverted Data Input	3A	
73		GND	Ground	1A	1
74	CML-I	Tx5p	Transmitter Non-Inverted Data Input	3A	
75	CML-I	Tx5n	Transmitter Inverted Data Input	3A	
76		GND	Ground	1A	1

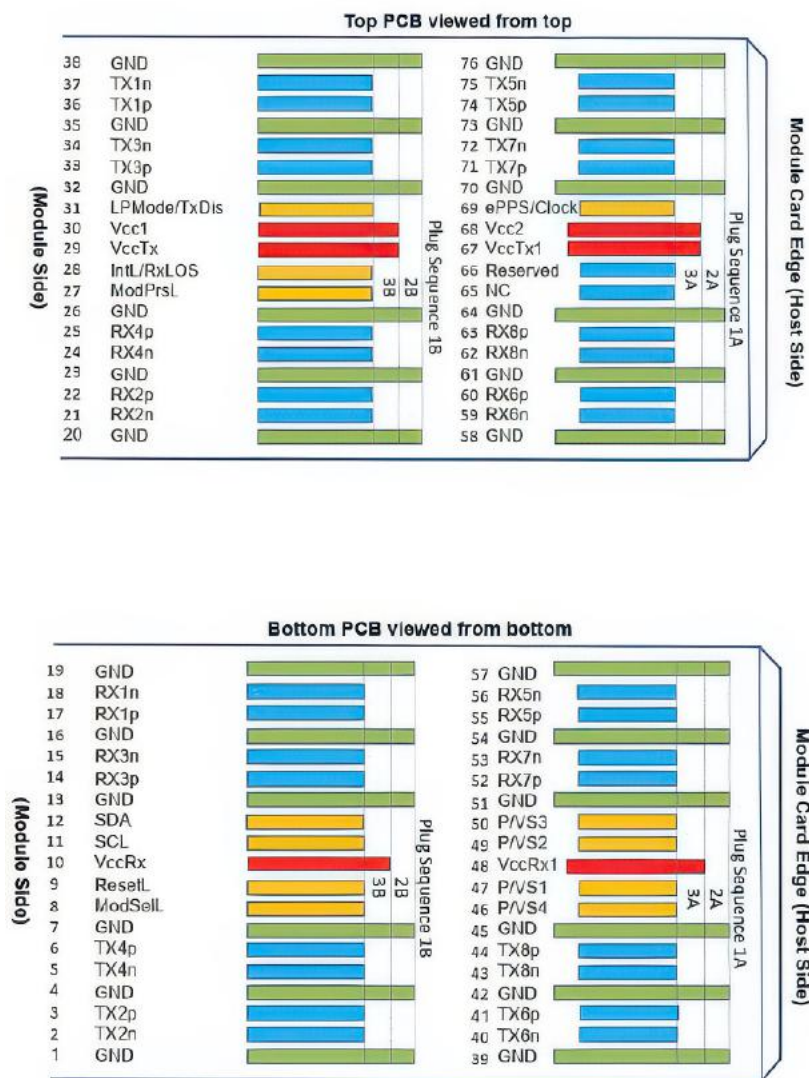
Notes:

1. QSFP-DD uses common ground (GND) for all signals and supply (power). All are common within the QSFP-DD module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.
2. VccRx, VccRx1, Vcc1, Vcc2, VccTx and VccTx1 shall be applied concurrently. Requirements defined for the host side of the Host Card Edge Connector are listed in Table 6. VccRx, VccRx1, Vcc1, Vcc2, VccTx and VccTx1 may be internally connected within the module in any combination. The connector Vcc pins are each rated for a maximum current of 1000 mA.
3. All Vendor Specific, Reserved and No Connect pins may be terminated with 50 ohms to ground on the host. Pad 65 (No Connect) shall be left unconnected within the module. Vendor specific and Reserved pads shall have an impedance to GND that is greater than 10 kOhms and less than 100 pF.



QSFP-DD Electrical Pad Layout

For detail mechanical information, please refer to the related document of QSFP-DD MSA.





Laser Safety Warning

This product is classified as a Class 1 Laser Product according to IEC 60825-1.
It complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

Caution: Use of optical instruments with this product will increase eye hazard. Do not view the laser beam directly with optical instruments or naked eyes.

Disclaimer

Images are for illustrative purposes only and may not accurately represent the actual product. Specifications and appearances are subject to change without prior notice.

The information provided in this datasheet is subject to change without notice. Lumulus Technologies assumes no responsibility for any errors or omissions. Performance may vary depending on application and operating conditions. Product specifications are provided for reference only and do not constitute a warranty.

For assistance and more information, please contact your sales representative or write to sales@lumulus.com

Lumulus Technologies, Inc. USA

Headquarters

9685 Via Excelencia Suite 106
San Diego, CA 92126
USA

 (+1) 858-397-2228

 www.lumulus.com

Lumulus Technologies, Inc. Thailand

Production site

Sri Ayutthagya - Thailand